Comparative Study of Micro debrider-Assisted Versus Radio frequency-Assisted Inferior Turbinoplasty

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Abstract

Objective: This study was carried out to compare post-operative outcome between microdebrider-assisted turbinoplasty and radiofrequency-assisted turbinoplasty in the treatment of chronic inferior turbinate hypertrophy using subjective and objective criteria.

Background: Chronic nasal obstruction is one of the most common human problems and a very frequent symptom in the ear, nose and throat field. Hypertrophy of the inferior turbinates is the most frequent cause.

Material and Methods: This prospective study was conducted on 60 cases with nasal obstruction and hypertrophied turbinate mucosa refractory to medical treatment, from October 2009 to June 2014. Thirty cases in this study were subjected to microdebrider assisted turbinoplasty MAIT (Group A operation) and the other 30 cases subjected to Radiofrequency-assisted Turbinoplasty RAIT (Group B operation). Post-operative changes in the degree of nasal obstruction, nasal discharge and snoring were evaluated by nasal endoscopy. Rhinomanometric evaluation was also performed for objective comparison.

Results: There were statistically significant differences between both groups regarding operative duration, blood loss and post-operative nasal obstruction, discharge, snoring and patient satisfaction in favor of microdebrider-assisted turbinoplasty.

Conclusion: This study suggests that microdebrider-assisted turbinoplasty is more effective and satisfactory in relieving nasal obstruction.

Key Words: Nasal obstruction – Microdebrider – Submucosal cauterization – Turbinate hypertrophy – Turbinoplasty.

Introduction

CHRONIC nasal obstruction is one of the most common complaints that an otolaryngologist may face during his medical practice. Possible causes may be septal deformities, nasal valve pathologies or mucosal diseases, such as allergic rhinitis and chronic rhino-sinusitis. Inferior turbinate hypertrophy, which is one of the most common causes of nasal obstruction, may be observed in allergic rhinitis, vasomotor rhinitis, chronic hypertrophic rhinitis or, sometimes, compensatory response to an evident septal deformity [1-3]. Medical treatment options such as anti-histamines, topical decongestants and corticosteroids are commonly prescribed to reduce the size of the turbinate with the aim of restoring nasal function. However, some cases show only slight improvement while some are even refractory to these medical treatments and the patients complain about persistent symptoms [4,5]. In these cases, surgical reduction of the inferior turbinate can be attempted. Various techniques have been described to reduce the volume of the mucosal and bony parts of the inferior turbinate. Conventional surgical options are total or partial turbinectomy, turbinoplasty, sub-mucosal turbinectomy, electrocautery and cryosurgery [4]. Although these methods may provide better results than medical treatment alone, adverse effects such as bleeding, crust formation, post-operative pain, synechia or atrophy of the inferior turbinate are common. One of the methods that yields satisfactory results with fewer side-effects is radiofrequency of inferior turbinates [5,6]. Radiofrequency energy is applied to the inferior turbinate causing an ionic chaos at cell level. This ionic change results in local heat increase, thus creating a deep thermal lesion. Healing occurs primarily with fibrosis which shrinks the surrounding tissue, in our case the inferior turbinate. In the late 1990s, a new instrument was introduced in the field of partial inferior turbinoplasty: Microdebrider was employed with the hope of achieving satisfactory turbinate reduction without sacrificing normal functions of the turbinate tissue [7,8]. However,
there have been only a few studies comparing the subjective and objective success rates and long-term post-operative results between these two minimally invasive methods: Radiofrequency versus microdebrider [9,10]. There is no study comparing postoperative results for more than 2 years for these two methods. We compared postoperative results of Microdebrider-Assisted Inferior Turbinoplasty (MAIT) and Radiofrequency Assisted Inferior Turbinoplasty (RAIT) for 3 years.

Material and Methods

This prospective and interventional study was conducted in the Department of Otorhinolaryngology and Head and Neck Surgery during the period of October, 2009 to June 2014 in Hearing and Speech Institute. A total of 60 cases of inferior turbinate hypertrophy were included in this study. These cases were randomly divided into 2 groups, group RF and group MD consisting of 30 cases in each group. Patients with chronic nasal obstruction due to inferior turbinate hypertrophy who were not responding to medical treatment like antihistamines, topical steroids and local decongestants included in the study. Both unilateral and bilateral inferior turbinate hypertrophy were taken for study but in cases where bilateral inferior turbinate hypertrophy was present, each separate hypertrophied inferior turbinate was taken as separate case for study. Cases having allergic rhinitis, acute rhino sinusitis and/or cases getting relieved with antihista-mines/topical steroids/local decongestants were included in the study. The surgical outcomes for both procedures were assessed the severity of symptoms. Symptoms were scored as 0 (no symptoms) to 10 (most severe symptoms). And objective evaluation by active anterior rhinomanometry. The objective total nasal resistance, respectively. All patients were evaluated prior to surgery and at 1 months, 1, 2, and 3 years.

Surgical techniques:

The microdebrider submucosal turbinoplasty procedure was performed under general anesthesia and under endoscopic guidance. A submucosal pocket was dissected by tunneling with microdebrider blade with dissecting tip in an anterior to posterior and superior to inferior sweeping motion. A 2.9mm diameter microdebrider tip (Medtronic-Xomed®), rotating continuously in a circular fashion and set at 3,000rpm while using suction irrigation, was applied to remove all the stromal tissue possible from inside of the turbinate. Particular attention was paid to preserve the mucosal flap during this removal process. For patients with hypertrophied turbinate posterior end (tails), the same procedure was performed from a second entry point made at the mid-portion of the inferior turbinate to gain better access to treat the "mulberry-tip" of the inferior turbinate. The nasal passages were packed with a piece of Merocel® (Medtronic-Xomed®) for a one day.

Radiofrequency turbinoplasty was performed under local anesthesia. We used the ENTecCoblator Plasma Surgery Sys-tem® (Arthrocare Corp®) with a voltage range of 96 to 312 voltage root-mean-squares (Vrms) at 100kHz. The wand was damped with 0.9% normal saline to permit the plasma field to form during insertion. All surgical procedures were performed under endoscopic guidance. After packing each nostril parallel to the inferior turbinate with piece of cotton soaked with 2% xylocaaine and 1:100,000 epinephrine, the tip of the probe was inserted submucosally at the anterior head of the turbinate and extended to the posterior portion of the inferior turbinate (three entries per turbinate, one at the medial surface of inferior turbinate, one at the turbinate surface facing the inferior meatus and one parallel to the nasal floor). Then, the inferior turbinate was ablated with an output power level of four (168-182 Vrms) in the posterior to anterior direction. The wand was kept in position for 15 seconds unless the whitening of the overlying mucosa of the applied region was noted. The withdrawal was performed at coagulation mode. Great care was taken not to injure the mucosa of inferior turbinates. After surgery, nasal packing with Merocel® was continued for 1 day depending on bleeding.

The surgical outcomes for both procedures were evaluated with respect to three distinct parameters: Two parameters were used to assess subjective patient complaints (nasal obstruction, rhinorrhea and snoring), by Visual Analogue Scale, (VAS) to assess the severity of symptoms. Symptoms were scored as 0 (no symptoms) to 10 (most severe symptoms). And objective evaluation by active anterior rhinomanometry. The objective total nasal resistance, respectively. All patients were evaluated prior to surgery and at 1 months, 1, 2, and 3 years.
after surgery. Patients were permitted to use intranasal inhalation of fluticasone propionate, when the symptoms of nasal allergy occurred within 1 year after surgery in both groups. One year after surgery, patients were treated with an oral antihistamine or intranasal steroid spray or both to relieve symptoms of nasal allergy on appropriate days. They were requested not to use oral or topical steroids, antihistamines or vasoconstrictors 2 weeks before each visit. A standard visual analogue scale ranging from zero (no symptoms) to 10 (the most severe symptoms) was used to assess subjective patient complaints, including nasal obstruction, sneezing, and snoring. The third, the patients’ satisfaction with the procedure was evaluated according to a four-point scale pre-operatively and on the 7th day, and in the 1th and 3rd months after the procedure (Table 1).

Table (1): Four-point scale of patient’s satisfaction.

<table>
<thead>
<tr>
<th>Score</th>
<th>Satisfaction with the procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>I am not satisfied</td>
</tr>
<tr>
<td>1</td>
<td>I am a little bit satisfied</td>
</tr>
<tr>
<td>2</td>
<td>I am moderately satisfied</td>
</tr>
<tr>
<td>3</td>
<td>I am totally satisfied</td>
</tr>
</tbody>
</table>

Statistical analysis:

Analysis of data was done by IBM computer using SPSS (statistical program for social science version 12) as follows. Description of quantitative variables as mean, Standard Deviation (SD) and range. Description of qualitative variables as number and percentage. Chi-square test was used to compare qualitative variables between groups. Fisher exact test was used instead of chi-square when one or more expected cell <5. Unpaired t-test was used for comparison of quantities variables, in parametric data (SD<50%) of mean. p-values of less than 0.05 were considered statistically significant and of less than 0.01 were considered highly significant. While p-values more than 0.05 were considered statistically insignificant.

Results

Among the 34 patients, 8 patients had unilateral ITH (Inferior Turbinate Hypertrophy) and 26 patients had bilateral ITH (21 men and 13 women). In effect 60 turbinoplasties were done. The age varied from 14 to 45 years in both group and the mean age was 27.86 years. The maximum incidence of ITH was seen in age group of 21-30 years (55.6%). All the cases in MD group were packed anteriorly after the procedure and these packs were removed after 24h. The mean operating time for group RF came out to be 14.7min. and for group MD was 29.3min. with p-value <0.0001. There was extremely significant difference in operating time of two groups (p<0.05 is considered to be significant.

Post-operative follow-up and Subjective assessment:

None of the patients in either of the surgical groups developed active bleeding during or after surgery. While mucosal tears were noted in the MAIT group (13.3%, 4/30) and not in the RAIT group, there was no loss of mucosa in either group. Postoperative crusting and synechia developed in the MAIT group (3/30 and 0/30 cases, respectively) and not in the RAIT group (0/30 and 0/30 cases, respectively). While one of the 30 cases experienced nasal dryness after surgery in MAIT group, none in RAIT group experienced nasal dryness. None of the patients in either of the two groups experienced atrophic rhinitis during the postoperative follow-up period. Both procedures were perfectly tolerated by the patients. In radiofrequency group, the only major complaint reported by the radiofrequency group was the worsening of nasal obstruction during the early days of the operation, sometimes lasting a week and gradually improving over the course of one month. The nasal symptoms as nasal obstruction, rhinorrhea, and snoring decreased significantly from 6 months to 3 years after surgery in the MAIT group compared to their preoperative values [p<.05 for all, (Table 1)]. Although all the symptom scores of the RAIT groups significantly improved 6 months to 1 year postoperatively compared to their preoperative levels (p<.05, both), no improvement of nasal symptoms from 2 to 3 years postoperatively was noted (p>.05, both). Then nasal symptom scores for nasal obstruction, rhinorrhea, and snoring between the MAIT and RAIT groups did not significantly differ 6 months after surgery (p>.05), but not from 1 to 3 years after surgery (p<.05 for all).

Objective symptom assessment:

The mean total nasal air resistance measured with rhinomanometry, were similar in both groups prior to treatment (p>0.05). The MAIT group showed significant decreases in rhinomanometric test results at 6 months, 1 year, 2 years, and 3 years postoperatively compared to preoperative values (p<.05 for all), (Table 2). Although the mean total nasal resistance for the RAIT group significantly improved from 6 months to 1 year postoperatively compared to their preoperative levels (p<.05, both), no further improvement in mean total nasal resistance was noted for postoperative years 2 and 3 (p>.05, both). The mean total nasal resistance between
the MAIT and RAIT groups did not significantly differ 6 months after surgery \((p > 0.05)\), but not from 1 year to 3 years after surgery \((p < 0.05\) for all).

Patient satisfaction patient satisfaction levels as obtained from the results of the “Satisfaction with the procedure” questionnaire improved significantly in the first week of the operation in the microdebrider group and persisted in the 3rd month of the operation, however, a slight decrease was noted in the 12th month of the operation. Statistically significant improvement in patient satisfaction levels was only observed in the first month of the operation in the radiofrequency group. This improvement also persisted in the 3rd month of the operation. The decrease in patient satisfaction levels was more evident in the radiofrequency group in the 12th month of the operation. “Patient satisfaction with the procedure” levels improved significantly better in the microdebrider group in the first week, the first month and the third month and postoperatively compared with the radiofrequency group \((p < 0.05)\). The results are summarized in Fig. (1).

Table (2): Nasal subjective symptoms (Mean ± SD). SD = Standard Deviation.

<table>
<thead>
<tr>
<th>Period</th>
<th>Turbinoplasty</th>
<th>Radiofrequency (No. 30)</th>
<th>Submucosal microdebrider (No. 30)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Obstruction</td>
<td>Discharge</td>
<td>Snoring</td>
</tr>
<tr>
<td>Pre-operative</td>
<td>8.52±1.02</td>
<td>6.64±1.51</td>
<td>6.54±1.16</td>
</tr>
<tr>
<td>1 months postoperative</td>
<td>1.44±0.64</td>
<td>1.67±0.68</td>
<td>1.57±0.66</td>
</tr>
<tr>
<td>1 years postoperative</td>
<td>4.52±2.21</td>
<td>3.07±1.52</td>
<td>3.66±1.40</td>
</tr>
<tr>
<td>2 years postoperative</td>
<td>8.03±1.33</td>
<td>6.06±1.29</td>
<td>6.05±1.50</td>
</tr>
<tr>
<td>3 years postoperative</td>
<td>8.29±1.36</td>
<td>6.48±1.39</td>
<td>6.14±1.34</td>
</tr>
<tr>
<td>(p)</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
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</table>

Table (3): The mean total nasal resistance (Mean ± SD) before and after surgery between RAIT and MAI.

<table>
<thead>
<tr>
<th>Mean total nasal resistance</th>
<th>RAIT</th>
<th>MAIT</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-operative</td>
<td>30±0.5</td>
<td>31±0.7</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>1 months postoperative</td>
<td>15±0.06</td>
<td>15±0.04</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>1 years postoperative</td>
<td>15±0.9</td>
<td>15±0.3</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>2 years postoperative</td>
<td>28±0.5</td>
<td>15±0.4</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>3 years postoperative</td>
<td>30±0.6</td>
<td>16±0.3</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

\(SD\) : Standard Deviation.

\(RAIT\) : Radiofrequency-Assisted Inferior Turbinoplasty.

\(MAIT\) : Microdebrider-Assisted Inferior Turbinoplasty.

Discussion

The principal goal of turbinate surgery is to obtain an improvement in nasal-breathing ability for recipients while at the same time preserving the physiological function of the nasal passages and mucosa, and eliciting minimal discomfort or adverse effects. Two mucosa-preservation techniques, microdebrider and radiofrequency inferior turbinoplasty, are widely used for treatment of hypertrophic inferior turbinates the use of a MD for surgical treatment of hypertrophic inferior turbinate was first reported by Davis and Nishioka [11,12] who states that an endoscopically-controlled partial inferior turbinectomy technique using a power microcutting instrument is fast, effective and well tolerated, with extremely low morbidity. It was hoped that preservation of the turbinate will allow more physiologic airflow distribution within the nasal passages. This instrument can be used on the external turbinate surface as well as intra-turbinally, often in combination with the nasal endoscopes. Intraturbinal surgery has an advantage of not damaging the mucosa [13]. The intraturbinal excision method was adopted in present study to avoid mucosal injury thus minimizing the chances of synechia formation. The main disadvantage of this MD is cost and the tip is frequently get obstructed due to small diameter lumen of MD when used intraturbinally and can bring about the prolonged operating time [13]. The advantage of RF
surgery is that a lower temperature is required to ablate the tissue than electrocautery or laser surgery. Temperature of the target is localized and ranges from 60 to 90ºC, with limited heat dissipation and thus minimize the damage to adjacent tissues. Cell death occurs when temperature reach 49.5ºC. Temperature induced by electro-cautery and laser surgery are significantly higher (750-900ºC) than that required for cell death and this results in significant heat propagation. RF is considered to be more accurate, with minimal injury to collateral tissue [14]. Thus, we compared the long-term efficacies of the two surgical techniques Lee and Chen had a study on microdebrider turbinoplasty reported that wound healing conditions during follow-up were very good with endoscopy. There was almost no crusting in the second week postoperatively [15,16]. Similar to the study done by Cingi and his colleagues [17]. In the microdebrider group, nasal obstruction, rhinorrhea, and snoring significantly improved 6 months to 3 years postoperatively compared to their preoperative levels (p<.05, all). Although all the symptom scores of the radiofrequency group significantly improved 6 months to 1 year postoperatively compared to their preoperative levels (p<.05, all), no further improvement occurred at 2 and 3 years postoperatively (p>.05). Radiofrequency achieved effects similar to those of microdebrider at 6 months postoperatively (p>.05), but not at 1, 2, and 3 years postoperatively (p<.05). This result could be explained by the fact that thermal injury and fibrosis or shrinkage of the submucosal turbinates, especially the anterior head of the inferior turbinates, could be insufficient in patients with prolonged hypertrophy, [18]. Leading to unsatisfactory volume reduction at 1, 2, and 3 years postoperatively in the radiofrequency group. Because microdebrider removed submucosal tissue more thoroughly than radiofrequency, including reducing the numbers of inflammatory cells and damage to the postnasal nerve branch. [9,19]. It is reasonable that microdebrider improved patients' long-term symptoms more effectively than radiofrequency. Although the correlation between nasal obstruction symptoms and total nasal resistance remains controversial [20,21]. Rhinomanometry is an objective method for evaluating the relative level of nasal patency [22]. Cavaliere et al., reported that rhinomanometric measurements demonstrated a significant decreases of nasal resistance at the 3-month postoperative visit in their 25 patients who underwent radiofrequency turbinoplasty [23]. Huang and Cheng reported that the improvement of nasal resistance was observed 1 year after endoscopic MAIT [24]. We rhinomanometrically assessed nasal resistance to air passage, which significantly improved at 6 months to 3 years after surgery in the microdebrider group. The mean total nasal resistance for the radiofrequency group significantly improved at 6 months to 1 year postoperatively compared to the preoperative levels, while no improvement at the 2nd and 3rd years postoperatively was found. Therefore, the improvement in nasal resistance is consistent with patients' subjective interpretations of longterm results and satisfaction. The results of microdebrider procedure coincide with other authors like Cingi and associates. They concluded that microdebrider-assisted partial turbinoplasty is more effective and satisfactory in relieving nasal obstruction. Same results reported by Dewidar et al., [25]. The results of radiofrequency is relatively matching the results of Kafle et al., they have performed a prospective study to evaluate the efficacy of radiofrequency and Partial Resection of Inferior Turbinate (PRIT) in the treatment of symptomatic enlarged inferior turbinate. They concluded that radiofrequency should be performed in all patients with inferior turbinate hypertrophy unresponsive to medical treatment. If inferior turbinate hypertrophy recurs following radiofrequency, Partial Resection of Inferior Turbinate (PRIT) should be carried out [26]. Salzan and colleagues performed a nonrandomized controlled trial to compare the microscopic and macroscopic effects of radiofrequency, high-frequency, and electrocautery therapies with partial inferior turbinotomy in the treatment of nasal obstruction caused by inferior turbinate hypertrophy. They concluded that the partial inferior nasal turbinotomy was the best method of treatment as it was the most effective procedure that maintains satisfactory nasal physiologic integrity without damaging nasal mucosa or underlying nerves [27]. Chand et al., performed a comparative study of efficacy of mucosal electrocautery versus submucosal diathermy for the treatment of inferior turbinate hypertrophy of nose. They concluded that submucosal diathermy was found to be more successful in relieving the patients' symptoms and decreasing the size of the inferior turbinates when compared to mucosal electrocautery [28]. In our study, patient satisfaction from the procedure revealed that the satisfaction score was higher among microdebrider (Group A), when compared to radiofrequency (Group B), after 3 months, with statistically significant difference in between both group. Yañez and Mora [29]. Agree with this study in significant difference (decrease) of bleeding and crustation after use of microdebrider. Only 4/338 patients has crustation and 1/338 patients has bleeding and Saki and his colleagues [31] reported very low inci-dence of crustation after radiofre-
quency 1 ± 0.6 but in this study they use regular nasal packing for 1 to 3 days to avoid bleeding. Kizilkaya and her colleagues [10]. Conducted a prospective trial with 30 symptomatic patients who underwent simultaneous radiofrequency and microdebrider turbinoplasty on consecutive sides. They use acoustic rhinometry to assess outcomes to a follow-up of 6 months. Both procedures resulted in improvement in minimal cross sectional area with no statistically significant differences. Liu CM and his colleague [31]. Reported no significant difference (p > 0.05) between microdebrider and radiofrequency 6 months postoperatively while significant difference was reported between both groups (p < 0.05) from 1 year up to 3 years, which in line with this study. Passali and his colleagues [32]. Published results of a randomized clinical trial with 382 patients comparing six treatment groups, turbinectomy, laser cautery, electrocautery, cryotherapy, submucosal resection, and submucosal resection without fracture. After 6 years of follow-up, they found that submucosal resection resulted in the highest degree of nasal patency and restoration of mucociliary clearance.

Conclusion:
Submucosal microdebrider turbinoplasty: Is the technique of highest efficacy and least complication. Availability of the microdebrider in the operating room is the main problem in this technique but radiofrequency turbinoplasty: Is the simplest technique, easily done under local anesthesia. The efficacy is high (significant improvement) in the first year. During the second year, the efficacy is significantly decreased but still effective. Conventional surgical turbinoplasty: Is as effective as microdebrider but the complication namely crustation and bleeding in this method is higher. In addition, this method need much more fine skillful hand. This method is time consuming than the other two methods.

References


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